

Amendment after Final
Application No. 10/708,258
Attorney Docket No. 072160

AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions of claims in the application.

Listing of Claims

Claims 1-39 (cancelled)

Claim 40 (currently amended): A centrifugal fan motor for cooling a device, ~~the fan~~
~~motor~~ comprising: a motor component having a rotary section, a stationary section and a bearing
supporting the rotary section rotatably against the stationary section for rotation about a rotational
axis; and an impeller connected to the rotary section, wherein said impeller includes:

a rotational force transmission portion provided on an [[the]] impeller lower end, for
receiving driving force from the motor component;

a lower endwall portion fixed correspondingly to said rotational force transmission
portion, for structuring a wall; and

an impeller blade unit having plural blades, each of the blades at its lower end being fixed
outer-marginally to the upper surface of the lower endwall portion and each of the blades
extending axially to its upper end, the blades together defining an opening at an [[the]] impeller
upper end, and rotation of said impeller blade unit therein generating an airflow streaming along
the rotational axis through the opening ~~and towards outside~~ outward in a radial direction
perpendicular to the rotational axis, said impeller blade unit being dimensioned such that given

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that $2r$ represents the diameter to the outer circumference of the impeller blade unit, h represents the axial height of the impeller blade unit, and α represents a parameter, the relationships $2\pi r h = \alpha\pi r^2$, $4 \leq \alpha \leq 40$, and $r \leq 12.5$ mm are satisfied.

Claim 41 (original): A centrifugal fan motor according to claim 40, wherein the relationship $r \leq 5$ mm is satisfied.

Claim 42 (original): A centrifugal fan motor according to claim 40, wherein the relationship $n \geq 5000$ rpm holds, n representing the motor rotational speed.

Claim 43 (original): A centrifugal fan motor according to claim 40, wherein the relationship $n \geq 10,000$ rpm holds, n representing motor rotational speed.

Claim 44 (original): A centrifugal fan motor according to claim 43, wherein said impeller is at least partially made of a liquid crystal polymer, a carbon-fiber-reinforced liquid crystal polymer, a glass-fiber-reinforced liquid crystal polymer, a carbon-fiber and glass-fiber-reinforced liquid crystal polymer, soft iron, stainless steel, aluminum, or ceramic.

Claim 45 (original): A centrifugal fan motor according to claim 44, wherein the total length of said motor component and said impeller along the rotational axis is less than 100 mm.

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Claim 46 (withdrawn): A centrifugal fan motor according to claim 44, wherein said bearing includes a pair of axially separated bearing units and the relationship $1.5 < h/m < 3.0$ holds, m representing the axial separation between said pair of bearing units.

Claim 47 (withdrawn): A centrifugal fan motor according to claim 44, wherein said bearing includes a pair of axially separated bearing units and the relationship $1.0 < h/m < 4.0$ holds, m representing the axial separation between said pair of bearing units.

Claim 48 (withdrawn): A centrifugal fan motor according to claim 44, wherein said bearing includes a pair of axially separated bearing units and the relationship $0.5 < h/m < 5.0$ holds, m representing the axial separation between said pair of bearing units.

Claim 49 (withdrawn): A centrifugal fan motor according to claim 44, wherein:
said bearing includes a pair of axially separated bearing units; and
the stationary section of said motor component includes a stator having a core unit and coil windings and being disposed axially between said pair of the bearing units.

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Claim 50 (withdrawn): A centrifugal fan motor according to claim 44, wherein the lower endwall portion and a portion of said impeller aligned therewith form an upper wall of said motor component.

Claim 51 (withdrawn): A centrifugal fan motor according to claim 44, wherein a portion of said impeller aligned with the lower endwall portion forms an upper wall of said motor component.

Claim 52 (original): A centrifugal fan motor according to claim 44, wherein said rotational force transmission portion encloses and is fixed to the circumferential surface of said rotor holder.

Claim 53 (original): A centrifugal fan motor according to claim 44, wherein said bearing is formed by a slide bearing, and the relationship $1.5 < h/m < 3.0$ holds, m representing the bearing span axially.

Claim 54 (original): A centrifugal fan motor according to claim 44, wherein said bearing is formed by a fluid dynamic bearing, and the relationship $1.5 < h/m < 3.0$ holds, m representing the bearing span axially.

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Claim 55 (original): A centrifugal fan motor according to claim 44, wherein said bearing is formed by a slide bearing, and the relationship $1.0 < h/m < 4.0$ holds, m representing the bearing span axially.

Claim 56 (original): A centrifugal fan motor according to claim 44, wherein said bearing is formed by a fluid dynamic bearing, and the relationship $1.0 < h/m < 4.0$ holds, m representing the bearing span axially.

Claim 57 (original): A centrifugal fan motor according to claim 44, wherein said bearing is formed by a slide bearing, and the relationship $0.5 < h/m < 5.0$ holds, m representing the bearing span axially.

Claim 58 (original): A centrifugal fan motor according to claim 44, wherein said bearing is formed by a fluid dynamic bearing, and the relationship $0.5 < h/m < 5.0$ holds, m representing the bearing span axially.

Claim 59 (original): A centrifugal fan motor according to claim 44, wherein:
said bearing is formed by a slide bearing; and
the stationary section of said motor component includes a stator having a core and coil
windings, both sides of said stator being located within the axial span of said bearing.

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Claim 60 (original): A centrifugal fan motor according to claim 44, wherein:
said bearing is formed by a fluid dynamic bearing; and
the stationary section of said motor component includes a stator having a core and coil
windings, both sides of said stator being located within the axial span of said bearing.

Claims 61-63 (cancelled)

Claim 64 (original): A cantilever-type impeller that connects with a motor component to
form a centrifugal fan motor for cooling portable electronic devices and other small devices, an
impeller upper end corresponding to the impeller side of the fan motor and an impeller lower end
corresponding to the motor-component side of the fan motor being defined along the impeller
rotational axis, the impeller comprising:

a rotational force transmission portion provided on the impeller lower end, for receiving
driving force from the motor component;
a lower endwall portion fixed correspondingly to the rotational force transmission
portion, the lower endwall portion therein configuring a wall surface; and
an impeller blade unit having plural blades, each of the blades at its lower end being fixed
outer-marginally to the upper surface of the lower endwall portion and each of the blades
extending axially to its upper end, the blades together defining an opening at the impeller upper

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end, and rotation of said impeller blade unit therein generating an airflow streaming along the rotational axis through the opening and towards said lower endwall on its upper surface, said impeller blade unit being dimensioned such that given that $2r$ represents the diameter to the outer circumference of the impeller blade unit, h represents the axial height of the impeller blade unit, Z represents the number of blades in the impeller blade unit, d represents the thickness of the blade unit, and β represents a parameter, the relationships $2\pi r \epsilon h = \beta \pi r^2$, $3 \leq \beta \leq 30$, $2r \leq h$, and $r \leq 12.5$ mm, wherein $\epsilon = (2\pi r - Zd)/2\pi r$, are satisfied.

Claim 65 (original): A cantilever type impeller according to claim 64, wherein at the upper end opening of said impeller blade unit the blades at their inside corners are beveled at least partially in an arcuate contour.

Claim 66 (original): A cantilever type impeller according to claim 64, being at least partially made of a liquid crystal polymer, a carbon-fiber-reinforced liquid crystal polymer, a glass-fiber-reinforced liquid crystal polymer, a carbon-fiber and glass-fiber-reinforced liquid crystal polymer, soft iron, stainless steel, aluminum, or ceramic.

Claim 67 (original): A centrifugal fan motor for cooling portable electronic devices and other small devices, the fan motor including an impeller, and a motor component having a rotary section, a stationary section and a bearing, the bearing supporting the rotary section rotatably

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against the stationary section for rotation about the motor rotational axis, an impeller upper end corresponding to the impeller side of the fan motor and an impeller lower end corresponding to the motor-component side of the fan motor being defined along the motor rotational axis, said impeller connected with the rotary section and comprising:

 a rotational force transmission portion provided on the impeller lower end, for receiving driving force from the motor component;

 a lower endwall portion fixed correspondingly to said rotational force transmission portion, for structuring a wall; and

 an impeller blade unit having plural blades, each of the blades at its lower end being fixed outer-marginally to the upper surface of the lower endwall portion and each of the blades extending axially to its upper end, the blades together defining an opening at the impeller upper end, and rotation of said impeller blade unit therein generating an airflow streaming along the rotational axis through the opening and towards said lower endwall on its upper surface, said impeller blade unit being dimensioned such that given that $2r$ represents the diameter to the outer circumference of the impeller blade unit, h represents the axial height of the impeller blade unit, Z represents the number of blades in the impeller blade unit, d represents the thickness of the blade unit, and β represents a parameter, the relationships $2\pi r\epsilon h = \beta\pi r^2$, $3 \leq \beta \leq 30$, $2r \leq h$, and $r \leq 12.5$ mm, wherein $\epsilon = (2\pi r - Zd)/2\pi r$, are satisfied.

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Claim 68 (original): A centrifugal fan motor according to claim 67, wherein the relationship $r \leq 5$ mm is satisfied.

Claim 69 (original): A centrifugal fan motor according to claim 67, wherein the relationship $n \geq 5000$ rpm holds, n representing the motor rotational speed.

Claim 70 (original): A centrifugal fan motor according to claim 67, wherein the relationship $n \geq 10,000$ rpm holds, n representing motor rotational speed.

Claim 71 (original): A centrifugal fan motor according to claim 70, wherein said impeller is at least partially made of a liquid crystal polymer, a carbon-fiber-reinforced liquid crystal polymer, a glass-fiber-reinforced liquid crystal polymer, a carbon-fiber and glass-fiber-reinforced liquid crystal polymer, soft iron, stainless steel, aluminum, or ceramic.

Claim 72 (original): A centrifugal fan motor according to claim 71, wherein the total length of said motor component and said impeller along the rotational axis is less than 100 mm.

Claim 73 (original): A centrifugal fan motor according to claim 71, wherein said bearing includes a pair of axially separated bearing units and the relationship $1.5 < h/m < 3.0$ holds, m representing the axial separation between said pair of bearing units.

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Claim 74 (original): A centrifugal fan motor according to claim 71, wherein said bearing includes a pair of axially separated bearing units and the relationship $1.0 < h/m < 4.0$ holds, m representing the axial separation between said pair of bearing units.

Claim 75 (original): A centrifugal fan motor according to claim 71, wherein said bearing includes a pair of axially separated bearing units and the relationship $0.5 < h/m < 5.0$ holds, m representing the axial separation between said pair of bearing units.

Claim 76 (original): A centrifugal fan motor according to claim 71, wherein:
said bearing includes a pair of axially separated bearing units; and
the stationary section of said motor component includes a stator having a core unit and coil windings and being disposed axially between said pair of the bearing units.

Claim 77 (original): A centrifugal fan motor according to claim 71, wherein the lower endwall portion and a portion of said impeller aligned therewith form an upper wall of said motor component.

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Claim 78 (original): A centrifugal fan motor according to claim 71, wherein a portion of said impeller aligned with the lower endwall portion forms an upper wall of said motor component.

Claim 79 (original): A centrifugal fan motor according to claim 71, wherein said rotational force transmission portion encloses at least part of the circumferential periphery of the rotary section.

Claim 80 (original): A centrifugal fan motor according to claim 71, wherein said bearing is formed by a slide bearing, and the relationship $1.5 < h/m < 3.0$ holds, m representing the bearing span axially.

Claim 81 (original): A centrifugal fan motor according to claim 71, wherein said bearing is formed by a fluid dynamic bearing, and the relationship $1.5 < h/m < 3.0$ holds, m representing the bearing span axially.

Claim 82 (original): A centrifugal fan motor according to claim 71, wherein said bearing is formed by a slide bearing, and the relationship $1.0 < h/m < 4.0$ holds, m representing the bearing span axially.

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Claim 83 (original): A centrifugal fan motor according to claim 71, wherein said bearing is formed by a fluid dynamic bearing, and the relationship $1.0 < h/m < 4.0$ holds, m representing the bearing span axially.

Claim 84 (original): A centrifugal fan motor according to claim 71, wherein said bearing is formed by a slide bearing, and the relationship $0.5 < h/m < 5.0$ holds, m representing the bearing span axially.

Claim 85 (original): A centrifugal fan motor according to claim 71, wherein said bearing is formed by a fluid dynamic bearing, and the relationship $0.5 < h/m < 5.0$ holds, m representing the bearing span axially.

Claim 86 (original): A centrifugal fan motor according to claim 71, wherein:
said bearing is formed by a slide bearing; and
the stationary section of said motor component includes a stator having a core and coil windings, both sides of said stator being located within the axial span of said bearing.

Claim 87 (original): A centrifugal fan motor according to claim 71, wherein:
said bearing is formed by a fluid dynamic bearing; and

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the stationary section of said motor component includes a stator having a core and coil windings, both sides of said stator being located within the axial span of said bearing.